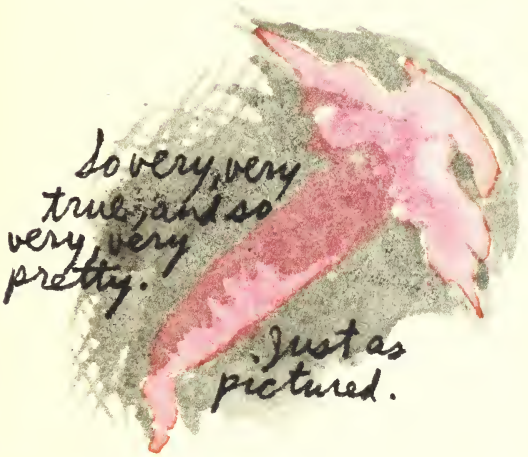
LANTERN SLIDES

HOW TO MAKE AND COLOR THEM

D. L. ELMENDORF



LANTERN SLIDES:

HOW TO MAKE AND COLOR THEM.

BY

DWIGHT LATHROP ELMENDORF.

Little Book! Yield enough light for the reader to discern the author's humble attempt to lend a helping hand.

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CONTENTS.

LANTERN SLIDES, HOW TO MAKE AND COLOR THEM.*

INTRODUCTION.

THE difficulties which meet the beginner at the start are many, and though some of them are real and are to be overcome only by care, patience and perseverance, yet most of the obstacles, which appear as mountains, soon disappear before the magic of common sense when applied under the guidance of practical experience.

The printed directions enclosed in each box of plates, while explicit enough for one well versed in the art, are Greek to the novice. The formulas puzzle some, the names of the chemicals, others; the chemical actions threaten distraction, while startling results, not at all in accordance with the directions, cause a total collapse.

The purpose of this little work is to guide those who will follow its directions as Alpine climbers do the "fürer," step by step, trusting to the direction of their leader, who has often surmounted the difficulties which lie in the path leading to a perfect lantern slide.

There are no short cuts to real success, but by using the best appliances and methods we

may speed over the path, enjoying each new difficulty as it appears, because of the assurance born of past successes.

The making of a lantern slide at the present time is comparatively a very simple process, because every requisite is prepared for the worker, ready for immediate use, and no knowledge of chemistry *per se* is necessary. The result, be it good or bad, depends entirely upon the " personal equation."

If this uncertain quantity were known in each particular case, it would be an easy matter to prescribe the proper treatment ; but as it varies even in one and the same person, the following directions will only apply to those who will not insert or assert their own personality too much.

It is taken for granted that the beginner has at least one good negative. If at all in doubt, it is best for the novice to have some one who knows select a good one to be used as a standard.

Long experience has taught the author that the negative is the first stumbling block.

Not many really know what a good negative for slide work is.

One which is rich in contrast, yielding a beautiful paper print, will make a good slide ; but it cannot be compared with one which was slightly overtimed, and therefore a trifle flat for paper prints, but clear and full of detail, the chemical deposit or grain of the plate being exceedingly fine.

D. L. Elmendorf.

SANTA MARIA DELLA SALUTÉ, VENICE.

This quality of negative has yielded slides which have been magnified up to 30 feet square, and still the lights and shades were beautiful.

Lantern-slide plates in this country are $3\frac{1}{4}$ inches wide and 4 inches long. Various manufacturers make plates of these dimensions, packed one dozen in a box, the latter being carefully sealed in order to keep all light from the plates. The plates manufactured for lantern slides are generally quite thin, and the glass is supposed to be especially selected; but, alas, there is plenty of room for improvement in this respect. The glass is coated with an emulsion of silver which is sensitive to actinic light.

By *actinic light* is meant any kind of light which causes a chemical change in the emulsion which can be detected or developed by using proper means. Throughout this work "actinic light" will mean the light used to photograph with, whether it is sunlight, gaslight, lamplight or candle-light.

A rainbow is composed of seven so-called colors. One edge of it is red, the other violet, with the five other colors lying between. By holding a common triangular glass prism in a sunbeam the same colors will be seen upon the ceiling or some part of the room. This beautiful band of seven visible colors is called the sun spectrum. Without entering into a physical discussion upon this subject, let it suffice to say that the glass prism decomposes the white (?) sunlight, or separates the various colors which together form white light, so that

we can see seven of them. If a small sun spectrum be allowed to fall upon a piece of sensitized or silvered paper, such as is commonly used for printing photographs, it will be found that the portion in the violet end of the spectrum will turn brown rapidly, while that in the red will be hardly affected at all.

From this we discover that red light has little or no effect upon the silver compounds used in photography, whereas they are instantly changed in the blue and violet; and careful experiments prove that there are many rays beyond the violet, which the human eye cannot distinguish at all, that are especially energetic in their action upon certain chemicals. The green and yellow portions of the spectrum have some chemical effect, but not nearly so much as the blue and violet.

A piece of "ruby" glass (gold flashed, not copper), held in the sunlight, absorbs or stops almost all of the colors of which sunlight is composed, except the red, which passes through and gives us only red light, if the glass is properly flashed or coated with a film of red glass.

This glass is the best and safest medium used for producing red light, which has little or no chemical effect upon the sensitive dry plate; and it is therefore recommended for lamps which are used to furnish light for developing the ordinary plates prepared for general photography. These plates are generally extremely sensitive to violet, blue, green and yellow light in their order.

The plates made for lantern slides are not nearly so sensitive. To use a technical term, they are "slower"; therefore, ruby glass is not necessary, although it is the safest.

There is a glass called "dark amber," which serves admirably when backed with a piece of ground-glass. It yields a soft brownish yellow light, which does not try the eyes, and can be used without danger while working with the slow lantern-slide plates.

Sunlight or daylight is the most actinic light that we have, next to which is the electric arc light, which is now being substituted for daylight in many of the best studios. Next in order is that produced by burning magnesium.

These are all especially rich in blue and violet light or actinic rays.

The incandescent electric light, gas jets and kerosene oil lamps yield light which also contains these actinic rays, but in a lesser degree.

The difference may be detected by using the triangular prism. The spectrum of these is especially rich in the yellow portion, therefore the light from these sources is not so actinic, but contains enough of the actinic rays to act instantly upon the sensitive dry plate. In fact, an ordinary gas jet is the source of actinic light which the author uses for exposing the slides in order to produce the image upon the plate.

As "ruby" or "amber" glass stops the actinic rays of sunlight, they will also stop those in other sources of light and allow the red light (non-actinic) to pass through so that the opera-

tor can see what is going on, without injury to the plate.

The beginner cannot be too carefully warned against the careless use of any of these sources of light while unprotected sensitive plates are around.

During the various operations of removing the sensitive plates from the packing box, putting them in plate-holders or in printing-frames, and in the manipulations of the plates during development and fixing, the plates should be carefully protected from any kind of actinic light, because they are very sensitive as compared with sensitized paper.

The reader must get the above warning firmly fixed in the mind, for it will save much vexation and annoyance later.

The effect which actinic light has upon the sensitive plate is wholly invisible, unless the exposure is continued for a long period of time. For example, take a plate, put it in a camera and make an exposure for one second, then examine the plate carefully. No change will be visible. That a change has really taken place may be proved by pouring upon the plate a solution containing certain chemicals, called the developer.

If a plate be exposed openly to daylight for several minutes or an hour, it will turn a gray or chocolate color; no chemicals are necessary in this case to show that a change has taken place. Chemists have not yet explained this wonderful action of light.

Fortunately the explanation is not essential so long as we can make use of this action, detect it, modify and extend it, until we obtain the object we desire, namely, the fixed result of the unknown chemical action of light, called the image on the plate. This is done by a process consisting of two steps ; 1st, developing the invisible image until it is seen ; 2d, fixing the image so that it will remain permanently upon the plate. Let us return to the experiments with the two plates exposed to actinic light. The first, which was exposed for a short time only, needed the aid of powerful chemical agents to bring out or develop the image.

The second needed none at all.

A logical conclusion may be drawn, that if, on one hand, a plate has been exposed an exceedingly short time to actinic light, the chemical agents applied to bring out or to develop the image must be powerful and be allowed to act upon the plate for a long time ; on the other hand, a plate exposed for a longer period requires less powerful agents to produce the image. Going a step further, we may conclude that a perfect balance may be obtained between the exposure and the developing agents, so that the chemical action of the latter will develop the invisible image produced by the former to a proper degree, and no more or less.

When this balance is attained, perfection is the result.

While this is theoretically easy, it is not often attained in practice on account of the many

variable quantities which enter into the calculation. For example, daylight varies at all times of the day and the year; therefore, it is a very uncertain element to deal with. Almost any source of steady, unvarying light is better for our purpose, such as a kerosene lamp, a gas jet or the electric light. The temperature of the room in which we work is another varying element, and especially the temperature of the developing solution itself, which should be between 65 and 75 degrees Fahr. A slight variation in temperature will cause a complete change in the action of the developer. The developers, which will be described subsequently, must be warmed or cooled, as the case may be, until they are of the proper temperature, otherwise they cannot be depended upon at all.

These difficulties, when once pointed out, ought never to trouble a careful worker.

The personal element now steps in, and this is the most unreliable quality of them all. It has a habit of exhibiting new phases every day, and often leads one to believe in the doctrine of the total depravity of things in general.

De gustibus non est disputandum; therefore "agree to disagree," if necessary, but follow the directions closely.

CHAPTER I.

The Contact Method.

TWO methods of making lantern slides will be carefully described. The first will be called the "contact method," which consists in printing on prepared sensitized glass, just as if it were paper. It is done by placing a negative in an ordinary printing frame, and then adjusting the gelatine surface of a prepared slide plate directly against the image on the negative, and keeping it in firm contact with the latter by means of the springs of the pressure board of the printing frame, while actinic light is allowed to shine through the negative upon the slide plate. The thicker portions of the negative stop the light to a certain degree, and, therefore, there is little or no chemical action upon the corresponding parts of the slide plate. The thinner portions allow more light to pass; therefore, there is more action upon the corresponding parts of the slide, so that the chemical action of the light upon the various parts of the slide plate depends upon the thickness of the respective parts of the negative. Moreover, it also depends upon the length of time that the light acts upon the plate.

The exposure may be so long that too much action takes place, even under the thickest parts of the negative, so that the delicate gradations

of action, so much desired, are completely lost, and the picture is seen through a veil of haze called "fog." Some have called it "atmosphere." Well, the atmosphere is sometimes "foggy"; but there is a difference between the natural and the chemical.

When a plate has been *over-exposed*—that is, exposed too long to actinic light—it invariably begins to change or "come up" as soon as it is thoroughly wet by the developer, and the developing action is often so rapid that no amount of manipulation can save the picture. In slide work it is only a matter of a few moments to make another and a shorter exposure; therefore much time and expense are really saved by refraining from tinkering with the developer or the over-exposed plate.

If it were a negative, and another exposure were impossible, any kind of dodging would be allowable, but it is "love's labor lost" on a slide. Then, again, the exposure may not be long enough for a sufficient amount of light to pass through any parts of the negative except the very thinnest. This is called *under-exposure*, and is much worse than its opposite. In this case the plate will lie in the developer for a long time before any change whatever is seen, and after it begins it will proceed so slowly that three or four slides, properly exposed, could be made and developed before the under-exposed one is nearly so; and even when this state does occur, if it ever does, the slide had better be converted into a cover glass at once, otherwise

it will be nothing but a failure in "black and white."

The author is unacquainted with any method that will produce a suitable deposit on an under-exposed plate, either a negative or a slide. It is trying to create, and that is impossible without divine power. A slight over-exposure may often be restrained by plunging the developing plate under very cold water and leaving it there until another very weak and cool developer, containing proportionately a large quantity of potassium bromide, is prepared for it. This method is very valuable for negatives, but is not advised for slides, because a better general average will result from the use of one standard developer, unchanged or unmodified, changing the time of exposure to suit the negative and the developer. There are enough variable quantities to guard against without adding still another.

Experience, although the most expensive, is the best of teachers; therefore allow it to lay down the following digest of twenty-one years' work.

USE:

First.—A standard negative.

Second.—A standard slide plate of one kind.

Third.—A standard actinic light.

Fourth.—A standard developer.

And change none of these invariables in the contest with the variable:

(*a*) Time of exposure.

(*b*) Temperature.

(*c*) Period of time the plate is in the developer.

(*d*) The mental state of yourself.

Have all things clean—darkroom, apparatus, plates and solutions, and especially your hands.

Don't be in a hurry; if you haven't time enough to make a good slide, it is better not to make any.

Requisites for the "Contact Method."

1. A controllable source of actinic light.
2. A means of measuring the time of exposure.
3. A lamp which yields non-actinic light.
4. Lantern slide plates.
5. A printing frame.
6. Trays for the various operations.
7. A camel's-hair duster.
8. A measuring glass, or graduate.
9. A glass funnel.
10. Absorbent cotton.
11. A means of washing the plates.
12. A plate rack.
13. A $\frac{1}{4}$-inch flat camel's-hair brush for the red prussiate of potash solution.
14. Lantern-slide mats.
15. Gummed strip of paper for binding the finished slides.

Chemicals Required.

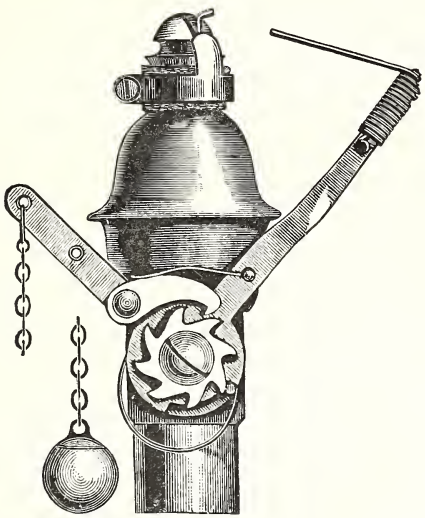
1. Developer.
2. Potassium bromide.
3. A bottle of acid sulphite of soda.

4. Hyposulphite of soda.
5. Powdered alum.
6. Red prussiate of potash.

All of these articles may be obtained from the publishers, and all except the developer may be obtained anywhere. Formulas for developers will be given later.

Each article will now be described in detail.

1. The most convenient source of actinic light is the incandescent electric lamp, which can be turned on and off, at pleasure.



Next in value is a gas-jet, controlled by a ratchet device and lighted by an electric spark. One pull of the pendant chain turns on the gas and lights it at the same time.

A second pull shuts off the gas, and, of course, extinguishes the light.

This apparatus, while it is admirably adapted to the purpose of exposing slides, is rather expensive; for, in addition to the jet itself, which costs $1.25, a spark coil ($3) and a battery of three or four cells (50 cents per cell), are necessary. The most convenient battery is the "dry" form of cell. The whole apparatus costs about $6. This is the form of actinic light used by the author, and it leaves nothing to be desired. Any length of exposure may be obtained with the utmost ease. It has never failed; and when the gas is turned off, the light is entirely extinguished.

Another form of jet, while not equal to the first in every respect, is quite well adapted to the purpose.

It is a gas-jet with a "by-pass," screwed upon a small iron stand, which may be connected with any gas fixture by means of rubber tubing.

The flow of gas is controlled by a stop-cock, which is connected with a very small "by-pass" tube at one side. The gas is first turned on and lighted as an ordinary jet.

As the stop-cock is turned, it opens the by-pass tube so that a very small flow of gas escapes at the orifice and is lighted by the main flame just before the latter is extinguished. This little by-pass jet continues to burn as long as the main jet is turned off.

When the main jet is gradually turned on, it is lighted by the small jet, which is completely extinguished when the main jet is full on.

There are two slight objections to this burner:

In the first place, the by-pass flame, although small, gives off some actinic light; therefore it is best to keep the burner at some distance from the developing table.

Secondly, it is liable to go out entirely if the stop-cock is turned with a sudden jerk. It is also liable to be blown out by the slightest down draft. If gas is not within reach, a kerosene lamp will answer, if it is placed in a light-tight, not air-tight, box, having a swinging door which may be easily opened and closed.

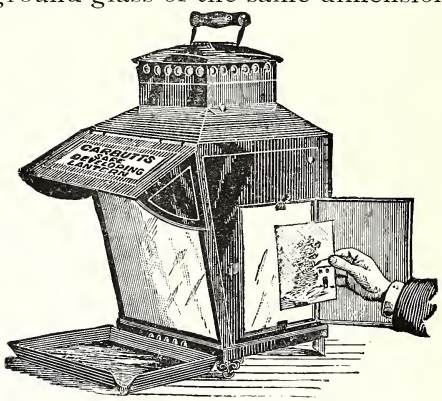
The author does not believe in "make-shifts" of any kind.

As a last resort, the lamp used for developing may be arranged with a swinging door, so that one source of light may serve the two purposes; but it is preferable to leave the developing lamp undisturbed.

2. The simplest and most convenient method of measuring the exposure of actinic light is by means of an ordinary cheap metallic clock, which has a good, loud tick that may be easily heard all over the darkroom. The author uses a 79-cent clock, which ticks four times to the second. It is placed on a shelf directly under the exposure gas-jet and measures off quarter, half or full seconds with unchanging accuracy, without requiring much mental strain on the part of the operator. The tick of the clock will enable one to repeat an exact exposure on any number of plates.

It is a very bad plan to trust to one's own sense of time in exposing lantern slides.

3. A good lamp for the developing table is an absolute necessity. A small one is an abomination for slide work. One of the best on the market is Carbutt's "Multum in Parvo," which can be very much improved by removing all the glass it contains and substituting ruby glass at the sides and an 8 x 10 "dark amber" glass in front, which should be backed by a piece of plain ground-glass of the same dimensions.



The addition of the ground-glass will surprise those who have never tried it, as it gives a diffused light that is delightful to work by. The slightest change in the plate can be detected at once, and, moreover, more light can be used without danger of fogging the plates than is possible without the ground-glass.

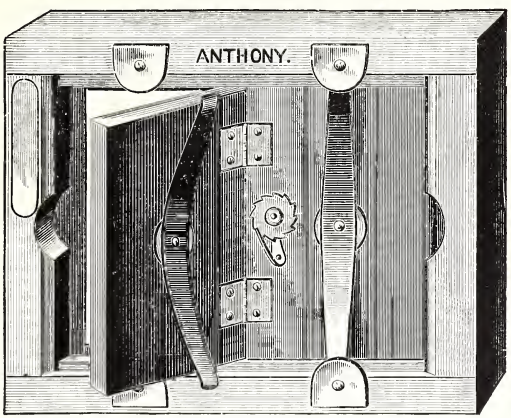
Instead of the kerosene lamp a gas burner upon a small stand which is connected with a gas pipe is used. A controlling stop-cock is

placed outside of the lantern so that the light may be increased or diminished at pleasure without opening the lamp.

4. For slide plates the author prefers Carbutt's and Cramer's.

5. One or two printing frames with the pressure board backed with black broadcloth which does not fray easily.

6. Four trays are required, two large enough to hold two $3\frac{1}{4} \times 4$ plates conveniently. These are to be used for developing only.



Improved Printing Frame.

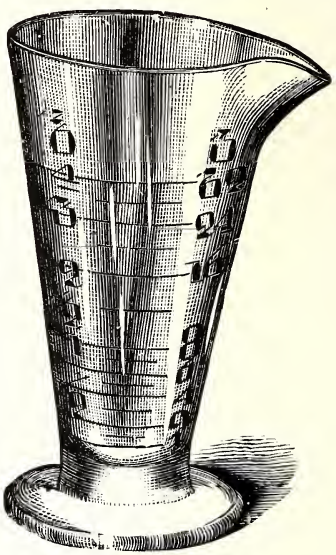
Deep white porcelain trays are recommended because they form a good contrast to the plate as it develops, and they show dirt when there is any.

A third one, large enough to hold four slide plates, is used for the hyposulphite of soda solution only; and the fourth, a tray of equal size, for the alum solution only. These trays should be used for the purposes indicated, respectively, and for nothing else.

To avoid the misuse of a tray, it is a good plan to mark each one. The gold paint liquid sold in all paint shops answers this purpose better than anything else. It resists the action of photographic chemicals for a long time and is plainly visible in ruby or amber light.

7. A good camel's-hair duster is a *sine qua non*. It should be at least 2 inches wide.

It must be washed first with soap and water and then with a little soda and water, after which it should be held under the tap until all soap and soda have been washed out; then partially dried with a clean towel and hung up to dry spontaneously in some place free from dust.



Graduate.

The fingers should never come in contact with this brush. A duster which has been in contact with the human skin will leave upon the plate that which is much worse than dust. In this connection remember that a finger mark upon a slide is not a beauty spot, even if made by a pretty finger.

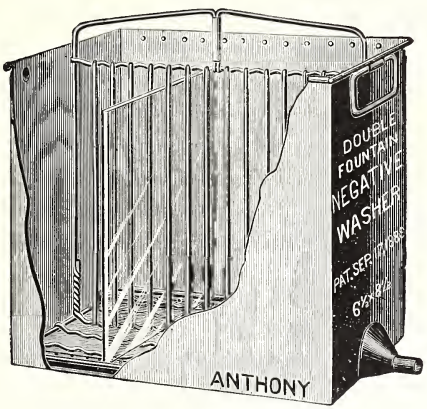
8. A measuring-glass or graduate—an 8-ounce one will answer. The ordinary thick precipi-

tating jars are just the thing for holding developers in use, as the liquid may be decanted, leaving the particles of dirt and gelatine upon the bottom.

They do away with the necessity of filtering the developer frequently.

9. One or two quart glass funnels, to be used with paper or absorbent cotton, as filters.

10. Absorbent cotton is very useful as a filter, and for swabs for swabbing of plates, as will be described.



11. A good wash-box for thoroughly washing the plates after they have been fixed. The permanency of the slide depends partly upon the thoroughness of the final washing.

12. A rack for holding the plates while they are drying spontaneously.

13. The use of the small camel's-hair brush will be described in its proper place.

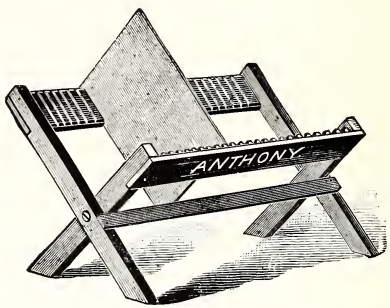
14. Lantern-slide mats are pieces of black

paper 3¼ x 4 inches, with an opening cut out of the center. The openings are of various shapes.

15. For gummed paper the author uses Sheplie gum paper, which works better than anything else on the market, and, being of a light color, the name of the slide can be written upon it.

Chemicals and Preparations Required.

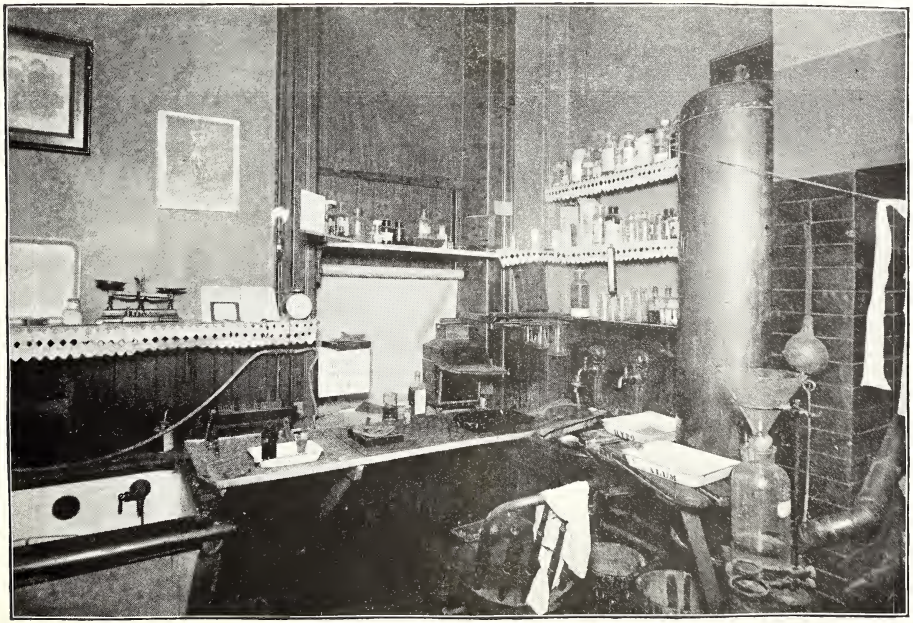
1. Developer. A bottle of Anthony's improved Hydroquinone developer, which comes prepared in 8 and 16-ounce bottles.



Drying Rack.

This developer is an admirable one for slides. It is clean, does not stain the fingers much, has wonderful keeping qualities, and will make as fine a slide as any developer the author is acquainted with.

Tom, Dick or Harry may have just as good a one, but the following directions are based upon this developer and upon the Carbutt or Cramer plates, and the author will shuffle off any and all responsibility if any others are used. No one can make a perfect negative or a perfect slide every time, so don't expect to.



THE LANTERNIST'S DARKROOM.

At the close, formulas will be given for those who desire to work out their own salvation.

2. An ounce bottle of potassium bromide. Take an empty ounce bottle, fill one-fourth of it with bromide crystals and then fill up with water. Shake it thoroughly; if all the crystals dissolve, put in some more and shake again. In a short time one can be satisfied that no more crystals will dissolve. When this state of affairs is reached, the solution is said to be "saturated." And a saturated solution of the bromide is what is wanted. Mark the bottle "bromide solution." It is used in connection with the developer.

3. The acid sulphite of soda is used in connection with hyposulphite of soda.

4. A solution of hyposulphite of soda, commonly called "hypo," or the fixing solution.

Take 8 ounces of hypo, put it in 32 ounces of water and shake until the crystals are dissolved, then add half a drachm of the acid sulphite of soda. Mark this bottle "hypo solution."

The acid sulphite keeps the hypo solution clear, so that there is no danger of staining the plates. A very small quantity is sufficient, too much is an evil. Hypo is very cheap, so don't work it to death. A fresh solution should be made every day or two if many plates are fixed, and a fresh solution is always safer even if only a few plates are to be fixed. Never use it if the solution is yellow or brown.

5. Put powdered alum into a pint bottle of water until no more will dissolve and some undissolved powder remains on the bottom of the bottle.

This forms a saturated solution of alum which must be filtered before it is used. It hardens the gelatine and prepares it for future applications of color.

6. The red prussiate of potash is very poisonous and should be handled with care. Its use will be indicated in an appropriate place.

Before beginning to make lantern slides be sure that the darkroom is quite clean, especially the developing table and the floor under and around it. It is the invariable custom of the author to wipe the table and floor with a damp cloth.

This precaution is always necessary, but particularly so if the room has been used for developing purposes previously. It is almost impossible to prevent some of the various solutions from dropping from the plates or fingers during the processes of development and fixing, and as the water soon evaporates, fine crystalline deposits are left, which ascend in the form of fine dust upon the slightest provocation.

This chemical dust has disastrous effects upon every photographic article it touches. It is worse than any form of bacilli, because there are no remedies for the evils it causes. A strict quarantine against the plague is the only safeguard.

Be sure that the source of actinic light and the developing lantern are in order. Fill the hypo tray half full of filtered hypo solution, and into the alum tray pour an equal quantity of filtered alum solution. Keep these trays away

from the developing table at all times with great care.

Measure out 3 ounces of Anthony's hydroquinone developer, as it comes prepared in bottles, and add 2 ounces of pure water. Croton water is liable to turn it yellow very quickly. Then add two or three drops of the bromide solution. This mixture forms the standard developer. Never allow anything else but plates to get into this developer.

Clean the back (the glass side) of the standard negative, dust off the gelatine surface with a camel's-hair duster, and place it in a printing frame, gelatine side up.

All the foregoing operations should be carried on by ordinary light.

At this point all actinic light of any kind should be shut off ; of course no stray rays of daylight should be admitted into the darkroom.

By the red or amber light of the developing lantern open a box of slide plates, dust off both sides of one, being careful to dust the gelatine side last, and place it upon the negative in the printing frame, so that the creamy white gelatine surface of the plate is in contact with the negative. Then take up the frame, holding the plates in contact gently with the thumbs, and adjust the slide plate over the desirable part of the negative, while looking through the plates at the developing light. When the desired position is obtained, lay the frame down level and adjust the pressure board carefully, so as not to move the slide plate. Unless this is care-

fully done, the negative may be scratched or broken.

Put away, or close, the opened box of plates.

The plate is now ready for exposure to actinic light.

Hold the frame so that the light, when turned on, may fall perpendicularly upon the negative at a measured distance from the source of the light, say, 2 feet.

These two points must be carefully noted, for, in the first place, the sharpness or distinctness of the image depends upon the direction in which the light passes through the negative. When the rays pass through it perpendicular (at right angles) to its surface, the sharpest image is obtained.

In the second place the negative should be at a known distance from the source of light, because the intensity or active power of light varies inversely as the square of the distance from its source. That is, if the negative, at a distance of 2 feet from the light, requires an exposure of four seconds, at one-half of the distance, 1 foot, it would require an exposure of only one second to obtain the same result. At twice the distance, 4 feet, it would require an exposure of sixteen seconds. Therefore be careful about these little things, or there will be variations in the results of the exposures, even when exactly timed.

To return to the work :

Hold the frame as directed and turn on the actinic light for two seconds by the clock. Re-

move the slide plate and write plainly, "two seconds," across the gelatine surface with a lead pencil. Put this plate away, or wrap it up light-tight for a few moments.

Adjust another slide plate on the same negative, and under the same conditions exactly expose it four seconds. Remove this plate from the frame, mark it "four seconds," and place it with the other exposed plate.

After testing the temperature of the developer, which should be about 70 degrees Fahr., pour it into a clean developing tray. The temperature should not be lower than 65 degrees nor higher than 75 degrees. A cold developer works too slowly and makes the plates black and white, while a warm one is too rapid in its action and causes a smoky appearance. It is better to have it just right.

The tray should be placed in front of, and about 6 inches from, the amber glass of the developing lantern.

Place the two exposed plates, gelatine side up, in the developer, and rock the tray back and forth so that the developer rushes over the plates in every direction. There must be enough developer in the tray to cover the plates to a depth of at least an eighth of an inch when the tray is level. Plenty of developer must be the rule.

The rocking motion must be kept up during the greater part of the time the plates are in the developer. Without this motion the plates develop unevenly, and are liable to be spotted or mottled, and will often appear like some of

the half-tone prints sometimes seen in magazines, which are wretched apologies, to put it mildly.

The plate marked "four seconds" will probably begin to change color slightly in about thirty or forty seconds. It may begin sooner. At all events it will begin before that marked "two seconds." The exact time to elapse before the action begins cannot be predicted by one unacquainted with the negative or slide plate used. Different emulsions, even by the same manufacturer, vary greatly in sensitiveness, no matter how they are marked. Don't get impatient, but keep on rocking the tray. If the outlines of the picture are not distinctly seen after sixty or a hundred seconds have elapsed, the indications are that the plates were not exposed long enough. If, however, one of them does come up nicely, the correct exposure may have been found in this first attempt, or it may be between two and four seconds. If they do not develop nicely, cover the tray with the top of a cardboard box to exclude light, leaving the plates in the developer, and expose another plate on the same negative, under the same conditions, five seconds exactly. Mark it and put it away. Then expose still another on the same negative, as before, six seconds. Mark this and put it with the five-second plate.

Remove the first two plates from the developer, rinse them off by holding them under a tap for a moment, and then put them into the hypo solution. Don't put your fingers into the

hypo. If the fingers are wet with hypo they should be thoroughly washed before any other work with plates or developer is attempted.

Put the last two exposed plates into the developer, and rock the tray as before. Probably one of these plates has been correctly exposed, so watch closely. The plate which had the longer exposure will begin to change color first. In a few moments after the plates are thoroughly wet by the developer, the outlines of the picture will begin to appear, somewhat as they do on sensitive paper in sunlight, only the color will be different, either brown or black ; and every little detail will gradually be seen increasing in distinctness and in depth of color, until it appears as a finished photograph, but more beautiful.

The plate which had five seconds exposure will "come up" or develop somewhat slower, but that is only to be expected because it was exposed a shorter time to the actinic light. When the former plate looks quite dark, the latter will appear lighter. Note carefully the degree of darkness of each plate as compared with the white bottom of the tray.

When the six-second plate has become much darker than you think it ought to be, take both plates out of the developer, rinse them off under the tap and place them in the hypo and leave them there for two or three minutes. Put away all the unexposed plates and turn on the actinic light.

Then take the first two plates out of the hypo,

rinse them off, and hold them up between the light and the eyes, placing a piece of ground glass between the plates and the light. Examine them carefully, by looking through them at the ground-glass. The plate exposed two seconds probably will have little or nothing upon it.

That exposed four seconds may have quite a good image, but very cold or black and white, and it may be very thin. Then take out the last two plates, rinse them off, and examine them by looking through them at the brightly illuminated ground-glass. The novice will probably be surprised to find all of the plates much thinner than when they were placed in the hypo. A short description of the cause of this may be of benefit.

The actinic light forms the invisible image, the developer causes a chemical reaction upon the molecules of silver which have been acted upon by the light, so that the image not only becomes visible, it also becomes a body as we understand the term.

The developer seems to pile up the molecules of silver upon the plate so that where there was the greatest action of light there is the greatest depth of deposit and *vice versa*. When the conditions are favorable, this is one of the most beautiful of all chemical actions.

As all of the molecules of silver upon the plate are not acted upon by the light when the exposure is correct, it is necessary to remove all those not developed, and the hypo does this ; it is called *fixing*. The greater part of the silver

on a plate is dissolved in the hypo, therefore the plate is much thinner when it leaves it. For this reason the plates must be developed much darker or thicker than at first seems necessary. The development must be kept on long after the picture looks very nice. The most difficult point in the whole process is the determination of the exact amount of deposit developed upon the plate.

In other words it is difficult to decide upon the exact moment to remove the plates from the developer. This desirable knowledge can only be attained by systematic experiments with one negative, one developer and one kind of plate, a tentative method which trains the eyes to a nice perception of detail and density or thickness of deposit.

Returning to the four developed and fixed plates, choose the best one and note the time of exposure written upon it.

Suppose, for example, it was five seconds. Expose two more slide plates on the same negative, giving each plate exactly five seconds at the same distance from the light, that is, under the same conditions as before. Put these plates into the same developer. Having an equal exposure they will develop alike. Develop them until they seem to be dark enough. Then remove one of them, rinse it and place it in the hypo, leaving the other in the developer a little longer, say ten or twenty seconds. Then remove it, rinse it, and place it in the hypo, so that it can be easily distinguished from the

other. After a lapse of two or three minutes they will be fixed enough for examination.

Compare them before the ground-glass and white light. Which is the better?

If it is the one removed last from the developer, be careful to develop other slides a little longer than is thought necessary.

If it was that removed first, try to imitate in every respect the manipulations which produced it. If they are both too dark, they were developed too long. Expose two more plates the same length of time the best slide had, and develop them. When they seem to be developed almost enough, take one plate out, rinse it under the tap for a moment and examine it by looking through it at the developing light for a moment. Study its qualities carefully by transmitted light. If the picture is a landscape, the trees and all shadows should appear very dark; the sky should show almost nothing at all. After noticing everything that is noticeable, the slide should be rinsed and placed in the hypo. This examination should not last over ten seconds. All this time the other plate is developing. Notice its appearance in the developer; remove it when it seems dark enough; rinse it and examine it also by transmitted light, taking care to notice all the points wherein it differs from the first one. After a careful examination, rinse it and place it in the hypo, keeping it apart from the other plate. It is easier for some to judge the density and quality of a plate by transmitted than by reflected light. After the plates

are fixed they may be examined, and the good and bad points of each carefully noted.

The above exposures were actually tried by a beginner, working under the author's directions, and the results were very gratifying to both pupil and instructor. The standard negative was known, and the series of exposures was arranged so that it would include the proper one, but the pupil was not aware of that fact. The pupil decided upon the correct exposure without any suggestions from his teacher.

If none of these exposures chance to be the right one for the reader's standard negative, other periods of exposure should be systematically tried after the same manner. After a few trials the correct exposure will be found.

This tentative method may seem to be a waste of plates on one negative, but it is not, even if thirty or forty plates are so used. Don't be discouraged by a few or by many failures. The most expert slide-makers don't obtain twelve fine slides from a dozen plates—not by a large majority.

By thoughtfully working this method out the novice will learn how to judge the quality of the slide as it develops, and when to remove it from the developer.

The principal idea of this method is to train the eyes so that the moment another negative is compared with the standard the proper exposure can be decided upon with a certainty that would astonish those accustomed to modify their developer to suit any haphazard exposure.

Therefore, keep at the standard negative until not only one, but several good slides are made from it, without modifying the developer at all. After being satisfied that a good slide can be made from the standard negative, mark the correct exposure upon one edge of the negative. Then compare all other negatives, from which slides are to be made, with the standard. Choose those which are of the same density and color, and place them in one pile. They will all need an exposure like that given to the standard. Those which are thicker or denser will require longer exposures; those which are thinner, shorter.

The color of the negative also necessitates a change in the length of exposure. Those which are gray require less than those which are black. Those which are yellowish require very long exposures.

It is only necessary to remember what was said in the introduction about the spectrum colors to see the logic of this.

After several plates (fifteen or twenty) have been developed in this one tray of developer, its action will be somewhat weakened and therefore slower. It is then advisable to throw away half of it, filter the remainder and add to it an equal quantity of new developer made up as directed in the first instance, omitting the bromide solution.

By renewing the energy of the developer in this way, a constant and even action may be kept up for hours. Never employ a developer

SIMPLON ROAD, ITALY.

D. L. Elmendorf.

which has once been used after it has stood for one or two days. The author has tried it and it made wretched slides.

Using fresh developer is like using a boiler having a steam gauge upon it—the pressure is known; while old developer is like an old gun that has been loaded for years, it may not go off at all, or it may, and take the immediate neighborhood with it, "there's no tellin'."

After the plates have been developed they should be left in the hypo at least five minutes; a longer time is safer. If a plate is removed from the hypo about a minute after it is placed therein and examined by looking at the back of it, the edges will appear dark, while the center is still white.

If the plate is dipped in and out of the hypo, the dissolving action of the chemical may be watched. Gradually the whole plate becomes dark and all of the white visible silver unacted upon by the light and developer seems to have been removed, but this is not so.

This action goes on long after the eyes can distinguish it; therefore it is necessary that the plate should remain in the fixing solution until it is thoroughly fixed. This is essential if the slides are to be permanent. If they are not thoroughly fixed, they soon fade and turn yellow. Actinic light should not strike the plates while fixing. After the plates are fixed they should be thoroughly washed in running water for at least two or three minutes and then while under the tap swabbed off with a wet tuft of absorbent

cotton and then placed in the alum bath. They should remain in this from two to five minutes. The exact time is immaterial.

The alum hardens the films so that they are not liable to leave the glass. The alum bath, moreover, is necessary if the slides are to be colored afterwards. After the alum has hardened the film, each plate should be placed under the tap, swabbed off with another tuft of cotton again, and then placed in the wash box and washed with cool running water for at least half an hour. If the hypo is not thoroughly washed out, it will stain the plate. It sometimes crystallizes in the plate long after the slide was made and ruins it.

After a thorough washing, each plate should be placed under a tap, swabbed off with cotton again, and then placed in a plate rack and allowed to dry spontaneously. The author uses a small electric fan which dries the slides in about half an hour.

When dry the slide may be mounted at once, by placing a lantern-slide mat directly upon the gelatine. By moistening one corner of the mat with the tongue and pressing it quickly and firmly upon the gelatine, it will adhere firmly so that it retains its position. Then a clean cover glass is laid on top of the mat and the two glasses are bound together with gummed strips of paper.

The cover glass protects the picture from being scratched, the mat between the glasses acts as a buffer, and slides well mounted may be quite roughly handled with impunity.

If the slides are to be colored they must not be mounted until afterwards.

Sometimes a reproduction of printed matter or of a line drawing is required.

The negatives of such subjects should be intense, but clear. Negatives which are very thick and black are often called intense when not so at all. A very poor flat image is masquerading under cover of a thick mass of fog—that's all.

Clearness is an essential for line work. The lines or printed matter should appear as clear glass on the negative.

After adjusting a slide plate on the negative, it should be exposed a very short time, say, one second or even a half second; this, of course, depends upon the clearness of the negative.

The exposed plate should be developed with Anthony's hydroquinone developer without dilution, adding one or two drops of the bromide solution to 3 ounces of developer. The development should be carried on till the lines or letters appear very black and the whites just the least bit tinged by the developer, when the plate should be removed, rinsed and thoroughly fixed.

This same method of procedure will often yield fine slides from negatives which are so thin that paper prints from them are an impossibility. Very intense negatives yield but fair slides at best, excepting those intended for line work, and the like. The proper method, with the exception noted, is long exposure and weak developer.

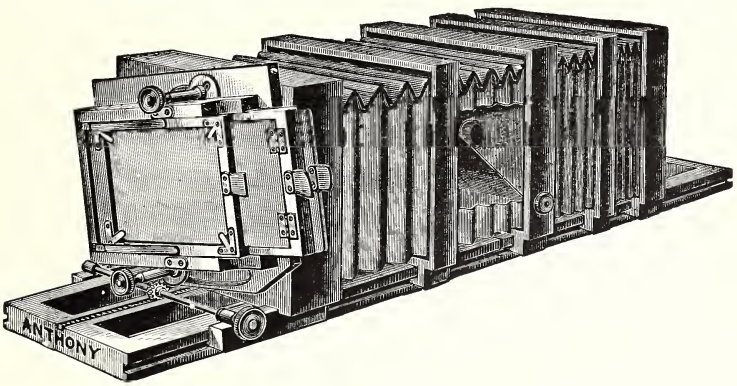
All experiments of this kind should be deferred until the reader is quite expert in making fair slides from good negatives. Like all good things, the contact method has its limitations. It is confined to the use of negatives with images of the proper size. As the largest opening in a standard lantern mat is 3 x 2⅞ inches, the size of the image must conform to that. Frequently the image is too large, even when within these limits, and produces a very inartistic, crowded effect when projected upon a screen. The very opposite sometimes occurs, but the former is so omnipresent that it is really a tremendous fault. Often the immense size of a certain object is toned down by the proportional dimensions of others near it. If there happen to be figures in the scene, they appear as mammoths. The author once saw upon a screen the image of a dog which measured 21 feet in length. This was followed by Niagara Falls, not quite 12 feet long and about 2 feet high, not half big enough to wet the dog. It is a common thing to see human faces appear 10 or 12 feet in circumference. The incongruity of such things is apparent, and can only be avoided by making negatives which are suitable for slide purposes, or by calling to our aid the camera method.

CHAPTER II.

The Camera Method.

THIS method requires a camera with a long bed and bellows to match, a lens of 4 or 5 inches' focus, and an adjustable hood, projecting in front of the lens in such a way that it extends to the frame which holds the negative, so that only those rays of light which pass through the negative can enter the lens.

The most convenient apparatus for this work is Anthony's lantern-slide camera, made at the suggestion of the author.



Anthony's Lantern-Slide Camera.

The frame carriage for the ground-glass and the plate-holder may be oscillated within certain limits, so that the image on the slide may be perfectly vertical, even if that on the negative is askew.

This camera is adapted to the use of 4 x 5 negatives, either horizontally or vertically. All its parts are adjustable, enabling one to enlarge or reduce the size of the image at pleasure. A flap shutter is placed just back of the lens frame, with an indicator which shows whether the lens is open or closed. This is an excellent piece of apparatus, and is not expensive.

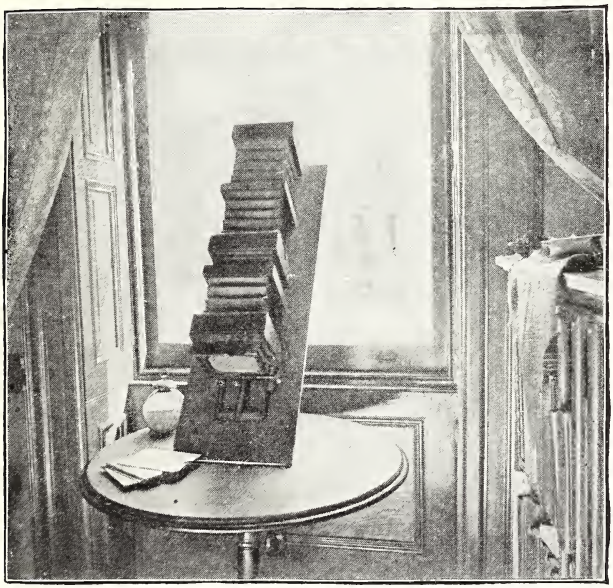
Larger cameras are manufactured, so that negatives of any size may be reduced to the proper lantern-slide size.

When a slide is to be made in this camera, the lens is first screwed into its front board and put in place; the negative is placed in the frame at the end of the camera farthest from the ground-glass, in such a way that the gelatine side is toward the lens and the image is upside down.

Then place the camera against a window at such an angle that it points directly toward the sky (not the sun), resting the lower end upon a table, or it may be directed toward a large piece of white cardboard brilliantly illuminated by daylight.

The lens frame is then pulled back from the negative the distance which the lens requires to form the image of the desired size. This distance depends upon the focus of the lens, and must be ascertained by experiment. Suppose it to be 14 inches. Then move the ground-glass carriage back and forth until the image upon the ground-glass is very sharp. This image will be right side up, but right for left as one sees himself in a mirror. If the image is too

large, the lens must be moved farther from the negative and the focus obtained again. If too small, the lens must be pushed nearer to the negative and the focus adjusted again. After the camera is once nicely adjusted for the average negative, the positions of the lens frame and



Camera Method.—Daylight.

ground-glass carriage should be marked in order that time may be saved on some future occasion.

A small stop or diaphragm should then be placed in the lens, for two reasons : it makes the image very sharp, and it increases the time of exposure, which is convenient when working by daylight.

When the camera is pointed at the sky there is a certainty that the negative will be evenly illuminated, whereas care must be taken if the light is reflected from a white screen. The screen must be adjusted at such an angle that the light will be reflected directly through all parts of the negative equally, and the screen or cardboard must not be too near the negative. If it is, a nice image of it will appear on the slide together with that of the negative, and will probably give rise to "cuss words."

Having secured a satisfactory illumination, the shutter is closed. A slide plate is put into the little plate-holder in the darkroom by non-actinic light.

The holder is then placed in its proper place in the camera, the slide drawn, and the exposure given by turning the shutter.

The length of exposure depends upon the lens used, the size of the stop or diaphragm, the size of the image, the negative, the time of day, the season of the year, and, lastly, the state of the weather or of the sky. Direct sunlight should not be used.

The only invariable quantities are the lens, its stop and the standard negative and developer. All the others are unreliable, and have to be tested by many experiments.

This method must not be attempted by those who are not able to make a good slide by the contact method.

To illustrate the extreme variability of daylight, the exposures given upon one negative,

just for experimental purposes, will be outlined.

January 7th.—Clear, at noon, one minute; 3 P.M., one and a half minutes.

January 8th.—Stormy, at noon, two minutes; at 3 P.M., four minutes.

January 9th.—Cloudy, at noon, one and one-fifth minutes; at 3 P.M., two and a half minutes.

January 10th.—Cloudy, at noon, two minutes; at 3 P.M., five minutes.

January 12th.—Clear, at noon, forty-five seconds; at 3 P.M., one minute.

January 18th.—Clear, at noon, forty-five seconds; at 3 P.M., one minute; at 4 P.M., two and a half minutes; at 5 P.M., seven minutes.

Lens, Dallmeyer 4 x 5 rapid rectilinear.

Stop, *f*/64.

Plate, Cramer lantern slide.

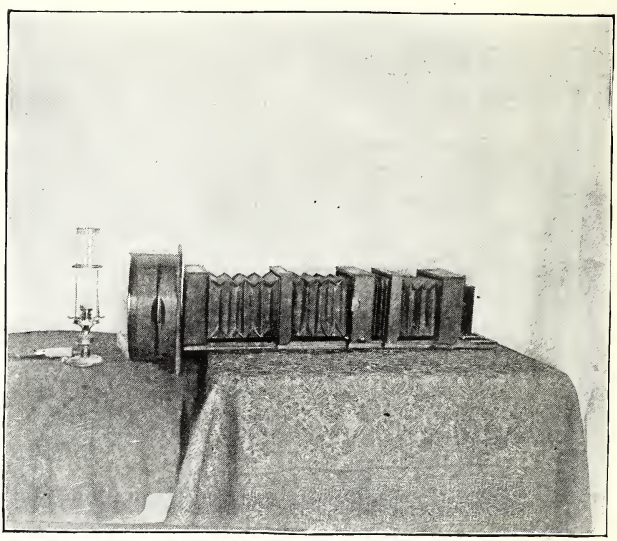
With an ordinary negative a lens of the rapid rectilinear type with a small stop, *f*/64, and upon a clear day at noon in January, an exposure of one minute should be tried; in March, a little less; in May half the time will suffice, etc., etc.

Using such a small stop, the variation of a few seconds in the exposure either way will not amount to much, because the plates are quite slow.

The standard developer for this work is 4 ounces Anthony's hydroquinone developer plus 2 ounces of water and no bromide. The development should be carried on exactly as directed for the contact method. If the exposure was too long, the plate will develop rapidly, and will be

smoky; if it was too short, the plate will come up to a certain point and stop, and all the dodges in the world wont help matters in the least.

To use the camera method by gaslight, another and a rather expensive piece of apparatus is needed, and that is a condensing lens of greater diameter than the diagonal of the negative.



Camera Method.—Artificial Light.

The author's apparatus is arranged as follows: The Anthony lantern-slide camera is adjusted as if for daylight, and placed upon a large table. The negative is put in place, and a pair of 8-inch plano-convex lenses, called a condenser, adjusted in front of, and as near as possible to, the negative. A Welsbach incandescent gas

burner is then adjusted before the condenser, so that the image on the ground-glass is evenly illuminated. Some care is necessary that the lens, the negative, the condenser and the gas-light are properly centered, in order to obtain an equal illumination.

This arrangement is nothing but a modified magic lantern, using the sensitive slide plate as a screen. The exposures are regulated by the flap shutter as before. The great advantage of this arrangement is that the light never varies and the results are uniform.

The Welsbach burner yields a beautiful, powerful white light, and has only one drawback, and that is its delicacy. The carbon net or cone is so delicate that a sudden jar will break it into thousands of pieces.

CHAPTER III.

Diseases and Remedies.

SOMETIMES the slide is beautiful, except for a *slight haze* or *fog*, caused often by over-exposure and sometimes by too warm a developer. This may be removed without injuring the slide by a careful and slow application of the following medicine: Dissolve 24 grains of hyposulphite of soda in 1 ounce of water. To this add from three to ten drops of a saturated solution of red prussiate of potash. This should be added, drop by drop, just before it is to be used, because the mixture does not keep longer than fifteen or twenty minutes, and should never be used except when freshly mixed. This mixture forms a clearing and reducing solution, the active power of which depends entirely upon the amount of potash added. The best results are obtained when it is so weak that two or three applications are necessary before any effect is seen.

After slides have been once dried, they do not respond with any degree of comfort to this treatment. It is best to apply it just after the plate has been removed from the hypo and rinsed off once or twice. Running water should be convenient, so that the action may be checked at any moment. Experiments upon worthless

WEST GATE, NÜRNBERG. D. L. Elmendorf.

plates should precede any attempts on a good slide.

To apply this remedy a $\frac{1}{4}$-inch camel's-hair brush should be dipped into the mixture and then brushed quickly, but gently, over the wet slide in every direction, while in a horizontal position; after which, the slide should be held under the tap for a moment, and then examined. It is well to have the brush full of the mixture before applying; otherwise, streaks may appear. If not cleared enough, repeat the operation. By using a little judgment one part of the slide may be reduced more than another at pleasure.

Remember that the action will continue for a short time after the slide is placed under the tap. After treatment, the slide should be washed for a few minutes, and then placed in the alum solution, and then washed thoroughly.

2. Sometimes a *slight veil* or *fog* is caused by the water used either in the making up of the developer or for washing the plates. Croton water is very liable to produce this effect. Remedy—dissolve $\frac{1}{2}$ an ounce of citrate of soda in 6 ounces of water, and pour this solution on and off the plate. Sometimes it is necessary to rub the plate with a tuft of absorbent cotton wetted with the solution.

3. A sky full of *opaque* and *transparent spots*. The opaque spots are sometimes in the emulsion itself; they are then incurable, but generally they are caused by minute transparent places in the negative, called "pinholes." Chemical

dust, mentioned before, is another source of this evil.

Transparent spots are often caused by poor manipulations in the development, little bubbles of air on the plate preventing the developer from acting on those portions of the slide.

They may be prevented by rocking the tray violently when the plates are first immersed. Sometimes it is necessary to rub the plate with the ball of a finger, which is wet with developer, but only the gentlest pressure must be used or the film will be scratched. A perfectly clean camel's-hair brush may be used, if it is very soft, but the delicate touch of the finger is better.

It is sometimes possible to clear up such a sky, without injuring the rest of the slide, by careful applications of the red potash mixture ; but the author prefers to block out the sky of the negative with Strauss marl and make another exposure.

4. The slide is very *thin.*

There are several causes of this disease; under and over exposure bring it on, and under-development aggravates it. Correct exposure, but not long enough development, will also result in thinness.

Remedy—make a new slide.

Having tried all the patent medicines labeled "superb formulas" for the intensification of slides, and failing in every case to make the consumptive slide equal in any respect to a new one exposed and developed correctly, the author

recommends the above remedy as a safe and sure one.

Intensifiers are like procrastination.

5. The slide is *too thick* and *dark*. This is the result of over-development. Take a small tray, fill it with cold water to a depth of one-fourth of an inch, and add to the water ten or twenty drops of the red potash solution and mix it well. Place the thick slide, as it comes from the hypo, without rinsing it at all, in this tray, removing it every few moments for examination. If no action takes place, remove the plate, add more potash solution, mix well, and then immerse the plate again. If properly adjusted this prescription will reduce the thickness of the whole plate to any desired extent. After treatment, wash under the tap for two or three minutes, place it in the alum solution for the usual time, and then proceed with the final washing.

6. Curious *stains* on one or more corners of the plate, caused invariably by some substance foreign to the developer which had not been removed from the fingers which held the plate.

Hypo, alum and red prussiate of potash take fiendish delight in producing these beauty spots; so beware of their pranks.

Remedy—none. Prevention is the best policy.

7. *Yellow tinge* to the whole plate, often caused by impure water, sometimes by old and decomposed developer or hypo solution. It may be remedied, but not always, by an appli-

cation of the red potash solution as in the first case.

An application of the citrate of soda will sometimes relieve it.

Weak hydrochloric acid will clear the plate, but is liable to take film and all with it.

This yellow tinge is sometimes inherent in the emulsion itself, and is hopelessly incurable. Get other plates.

8. *Frilling.* This peculiar disease is often caused by exposing the gelatine film to sudden changes of temperature. If a plate be removed from a developer which is 70 degrees and plunged into water or hypo at 45 degrees temperature, the chances are that the edges of the plate will frill. The gelatine expands and contracts more rapidly than glass, and therefore wrenches itself from its support, and seems to swell up in places to such a degree that it loses its power of contracting again to its original size. The alum solution will sometimes stop this, but will not remedy it. Lantern-slide plates are not so liable to frill as the more rapid negative plates, but it will happen on any plate which was not properly cleaned before the emulsion was applied.

There are many other diseases which are the results of careless manipulations, dirty fingers or apparatus and unpardonable thoughtlessness, which may never trouble a careful worker.

Only a short diagnosis of the evils, common to all, has been attempted.

Once again, allow sad experience to reassert

that time, temper and money are saved by making another exposure if the first was defective in any respect.

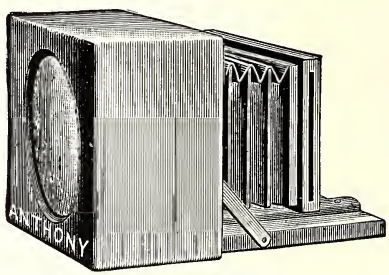
Poor slides often make excellent cover glasses, if they are free from bubbles and are well cleaned.

CHAPTER IV.

Testing Slides.

SLIDES which appear to be very good while wet should be carefully examined when dry. Generally they gain in density as they dry, especially if they are dried rapidly.

A very nice little instrument for testing slides is called a lanternoscope (see cut), which consists of a frame holding a convex lens, fastened to a folding bed on which slides another frame made to hold a lantern slide. This is connected with the lens frame by a bellows which excludes all light except that which passes through the slide. Upon looking through the lens at a slide inserted in place, an enlarged image is seen, and the general quality of the slide may be judged with great ease and pleasure.



When one does not wish to go to the trouble of lighting up the lantern, this little lanternoscope affords a convenient means of showing slides to friends or to pupils in a class-room.

The best test, however, is the lantern itself,

when under the conditions that the pictures are to be afterwards exhibited.

Slides which are just right for a lantern with oil light are not so for the oxyhydrogen jet. Again, those which are suitable for the latter are not the finest for the electric arc light.

Still further discrimination must be made when the size of the screen is considered. A slide which appears well upon a 6-foot screen will be disappointing on a 20-foot screen, appearing too dark because it is too thick. If another slide, but not so thick, from the same negative, be then projected upon the screen, the difference will be apparent; whereas, if the same pair of slides were judged upon the small screen, the former would be pronounced superior.

These points are rarely taken into consideration by judges of "prize" slides, yet they must be carefully weighed by the one who desires perfection on the screen.

Oil lamps of the best construction will project enough light through suitable slides to illuminate an 8-foot screen fairly well, but it is impossible to get a sharp image with any form of oil lamp because the source of light is not an approximate point.

The oxyhydrogen jet will illuminate slides adapted to it when magnified up to 20 feet square. For many reasons the author prefers this form of light to any other at present.

The electric arc should be used when any greater magnification than this is desired. The

author deprecates the use of the electric arc for projecting lantern slides upon small screens, and considers the effects very glaring and unpleasantly cold.

The arc light is superb for microscopic projections and for slide projections upon enormous screens or upon small screens in the class-room in ordinary diffused daylight.

As many may prefer to make up their own developer, several formulas will be given as used by the author. Some may be able to get better results from other formulas, and they had better do so; the author has not. There is nothing original about the following developers ·

I.

Saturated solution of oxalate of potash	5 ounces (fluid).
Saturated solution of iron sulphate	1 ounce "

Pour the iron into the oxalate, never *vice versa*, and add three to five drops of saturated solution of bromide of potash.

This developer gives beautiful results, ranging from gray to brown, according to the exposure, but will not keep long after mixing.

II.—Hydroquinone Developer.

A.

Hydroquinone	15 grains.
Sulphite of soda crystals	44 "
Bromide of potash	13 "

Water (pure) to make a total bulk of 10 ounces.

B.

Carbonate of soda.....	90 grains.
Carbonate of potash.....	90 "
Water (pure) to make a total bulk of	10 ounces.

Take equal portions of A and B, to form a normal developer.

This is the most convenient of all developers, as it may be used until it begins to act too slow, when half of it should be thrown away, the remainder filtered, and then an equal bulk of fresh developer added.

When made with pure chemicals and with distilled water, it will keep indefinitely.

III.—Metol.

Water.....	60 ounces.
Sulphite of soda crystals.....	6 "
Metol	1 ounce.
Bicarbonate of soda.....	3 ounces.
Bromide of potash (10 per cent.), a few drops.	

Dissolve in the given order.

This is the Cramer formula, and works well, but requires a shorter exposure than either I or II.

It is often necessary to project maps, diagrams, formulas, special solutions of problems, comic drawings and the like upon a screen at short notice.

In order to make a photographic slide of any of these subjects, the drawing must first be photographed and the slide then made from the negative, a long and expensive process when the slide is for temporary use only.

During a long experience in teaching the deaf, using the lantern as a means of illustrating the various branches of study, such as geography, history, physics, etc., and for the purpose of entertainment, some means of writing upon the slides was necessary. In a happy moment, carbon transfer paper was thought of and tried with great success.

By simply laying the carbon paper upon the clean cover glass of the slide and then superposing a piece of thin, smooth-finished paper, any inscription written on the paper with the sharp point of a hard pencil will be found perfectly transferred upon the glass if the latter was perfectly cleaned beforehand. Comic drawings, in fact anything of the kind of suitable size, may be transferred by this simple process of tracing.

The transfer slide should be matted and mounted as an ordinary slide. By transferring upon a gelatine surface which has been treated with alum, color may be applied.

CHAPTER V.

How to Color Slides.

"FOOLS step in where angels fear to tread" expresses the author's feelings when about to attempt the description of that which is indescribable.

The first rule to be learned and obeyed is, don't color slides, but tint them.

Unless one has real artistic feeling and a knowledge of tone and color, the slides had better remain as the developer made them.

Having tried every kind of pigment, paint and coloring matter obtainable, the author has settled down to a few aniline dyes, which have now stood the test of ten years very well. These were not chosen because they are easy to apply—in fact, they are much more difficult to use than some of the pigments mixed with Canada balsam, Damar varnish and other mediums—but because of their brilliancy and wonderful lack of "grain," even when greatly magnified.

The wail from some quarters that aniline colors are fugitive is quite true in a general sense, but by accident the author stumbled upon a certain addition which not only makes the colors quite permanent, but also prevents "creeping" when properly applied. After careful tests for ten years, the author now feels that

the colors are reliable, and will soon prepare them in quantity for the use of others.

Unfortunately they are expensive, but when the quantity necessary for ten slides is measured and the cost of the same computed, this bugbear disappears. Ten drops of some of the colors will color fifty slides.

The principal colors prepared by the author are:

1. Light yellow.
2. Dark yellow.
3. Orange.
4. Crimson.
5. Vermilion.
6. Dark brown.
7. Maroon.
8. Blue No. 1.
9. Blue No. 2.
10. Violet.

These ten colors are the elements from which countless tints may be formed by mixing one with another in various proportions.

The colors are very concentrated, and most of them should be diluted with clear water before applying.

The amount of water to be added must be ascertained by experiment in order to obtain the depth or strength of color desired.

Light yellow and orange mix in all proportions, forming various tints. The mixture should be diluted with about an equal quantity of water unless powerful colors are desired.

D. L. Elmendorf.

A WHITE-ASH BREEZE, HOLLAND.

Light yellow and crimson form useful tints for evening sky effects, and for flesh tints of a brownish tendency. Should be diluted before applying.

Light or dark yellow and vermilion in various proportions give endless gradations from the one to the other, and this is the chief mixture for flesh tints. Vermilion is the most powerful of all the colors, and should be diluted very much.

Light yellow and blue No. 1 mix in any proportions, forming pale greens. Should not be diluted. By adding some dark yellow, warmer and more brilliant greens are obtained.

The coldness or warmth of the green depends upon the amount of yellow added to the blue.

Dark yellow and blue No. 2 yield intense greens, and are especially useful in contrast with those of blue No. 1. Should not be diluted except in special cases.

Orange and blue No. 2 yield a splendid variety of earthy yellows and olive greens, which are very valuable for foregrounds, dead grass, etc.

A very slight addition of vermilion gives rich ochre tints. Should be diluted as necessary.

After applying these orange and blue mixtures it is well to wash off the slide with the same brush wet with water only, to prevent any deposit, which sometimes occurs.

Maroon and the yellows produce numerous tints, passing from yellow and brown to maroon. Should be diluted.

Dark brown is a reddish brown, and should be

diluted only a little, say with equal parts of water, unless a very pale tint is required. It will mix with other colors for a variety of tints.

Crimson should always be diluted with a large quantity of water.

Blue No. 1, when diluted with 5 to 10 parts of water, is suitable for skies and water, remembering that water reflects the sky and other objects above it, so that plain blue will not always answer for water, even when suitable for the sky.

Each portion of the day and the year has its own peculiar tints, both in sky and water, nor are all portions of either alike at the same time. One must study these wonderful color effects in Nature if any realistic results are to be hoped for.

Blue No. 2 is a greenish blue, suitable when diluted for either sky or water under certain conditions of atmosphere and light.

Violet, although apparently a powerful color, is not so, and is difficult to manipulate. It does not mix well with other colors, but beautiful purple tints may be obtained by first applying the violet to the part to be colored, and then, after it is set, but not dry, applying a very weak solution of vermilion until the desired tint is obtained, a process of blending which is quite difficult to the uninitiated.

With these few hints as to mixing the colors for various tints, the author hopes that the way is made clear. Thousands of tints may be obtained after the same manner.

Requisites.

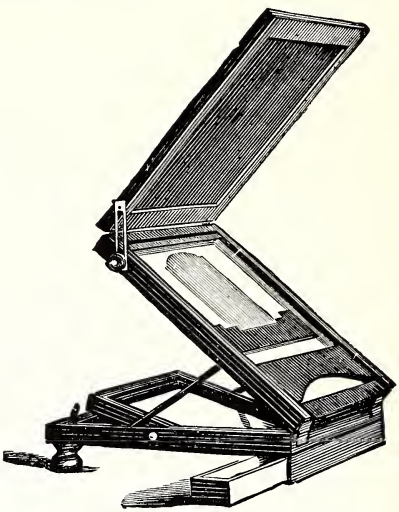
1. A nest of white porcelain saucers should be obtained, such as microscopists use. They are invaluable for slide work, as each saucer forms a cover for the other, so that all dust is excluded.

2. Each color should have a brush of its own, which should never be used for any other. The author uses three each for the majority of colors, Nos. 2, 3, and 4, soft round camel's hair.

They should be well made, and come to a point when wet.

For skies and water, or for general tints and blending, half-inch flat camel's-hair brushes should be used.

3. A large glass, capable of holding a pint of water, should be at hand, convenient for immediate use at all times.



4. For the purpose of adding water to the colors, there is nothing better than a rubber pipette, often used as medicine droppers, or for filling fountain pens.

5. A clean cloth attached to the table for the purpose of wiping color from brushes.

6. A retouching frame, such as is used for retouching negatives with a very fine ground-glass.

The author colors all his slides by means of a Welsbach incandescent gas burner, which gives a quality of light almost exactly like the oxyhydrogen jet.

7. A room without hangings, draperies, or carpet. The floor should be dampened before beginning the coloring. A room especially arranged for the purpose is advisable if the colorist desires any comfort at all in the work. Dust is a most vexatious nuisance. One little particle falling on the wet slide will stick closer than a brother, and will be painfully evident on the screen.

The gelatine surface of the slide takes the colors well if it has been treated with a saturated solution of alum as directed under development. The slide to be colored should be placed on the ground-glass of the retouching frame with a narrow strip of wood, about an eighth of an inch thick, under the lower edge so as to raise the slide slightly from the ground-glass, in order to prevent capillary attraction. The mirror and light should be adjusted so that the slide is properly illuminated. The sky should be colored first, and it is sometimes advisable to turn the sky toward the bottom or sideways during this part of the work; "gumption" will suggest the most convenient positions. Put a few drops of blue No. 1 in a saucer and dilute it with 8 parts of water, more or less. Take the half-inch blue brush, wet it full of clear water and moisten the sky evenly and thoroughly, using plenty of water in the brush.

If the brush is not full of water it is liable to stick to the gelatine or cause lines. Then draw the brush between the thumb and forefinger to remove most of the water, dip it in the dilute blue color in the saucer, and brush quickly back and forth over the wet sky.

Don't allow the brush to stop on the slide. By using dilute color and applying many times, a perfect sky may be obtained.

When a blended sky is desired, first wet the plate as before and take the half-inch orange brush, dip it in a very weak solution of orange or any other color and paint the lower portion of the sky with it, then dip the brush, still full of color, in clear water and gradually work up toward the zenith with this very weak color, then wash out the brush in water and blend from the bottom to the top of the sky. Then take the blue brush and wet it with water, dip it in the dilute blue color and brush across the zenith of the sky, gradually blending the blue down about half way. This blending operation is very difficult to describe ; it really ought to be seen to be thoroughly understood. The plate should be turned so that the color does not flow down over the foreground.

Large expanses of water are treated in a similar fashion.

Any number of harmonious tints may be blended in the same way, being careful to blend the colors in their proper order.

The author's method is to color the skies of several slides and place them in a drying rack

to dry before any other coloring is attempted.

When the sky is dry, other portions of the slide may be colored by applying the color to the dry gelatine.

Never try to apply another color to the slide until the first one has dried, unless blending is the object in view. In coloring trees, first give them a general pale tint of green and then work out each tree in detail with various tints of green.

Detached branches of trees, and conspicuous leaves demand careful treatment, which needs long practice, a steady hand, and an accurate eye. Flesh needs most careful treatment, and careful and repeated application of very dilute colors, until the desired effect is gained, is the best method. It is not always necessary to color every part of a slide. Very frequently the slide in some portions presents the natural appearance of the object, and color would only detract from the general effect.

If the slides are colored by ordinary daylight the effects will be rather surprising when viewed at night by means of the lantern. The arc light will reproduce the colors almost similar to day light, but neither oil or gas will accomplish this for physical reasons which were mentioned in the introduction. Therefore the author uses the Welsbach incandescent gas burner as the means of illumination. Slides should be colored for the light used in projecting them on the screen, and used with that light and no other.

After one slide has been colored successfully,

so that the worker is satisfied with its effects on the screen, other slides may be colored by ordinary daylight, using this slide as a guide to color.

Night effects may be obtained, by developing the slide very dark and then coloring the whole with blue No. 1, undiluted.

In mixing the colors, pour out one or more drops of color into a saucer and add water by means of the pipette. Never put a brush into the bottle of color.

In conclusion, allow the author to beseech anyone without "an eye for color" to leave coloring severely alone.

Some may be like the Irishman the author met last summer at Killarney, who, when questioned as to the benefits of Home Rule if they got it, replied:

"We don't know thot, but we're bound to have it."

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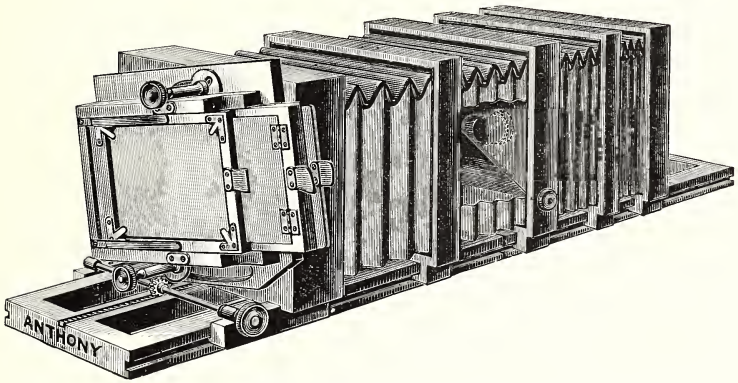

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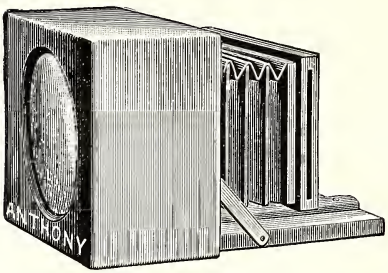

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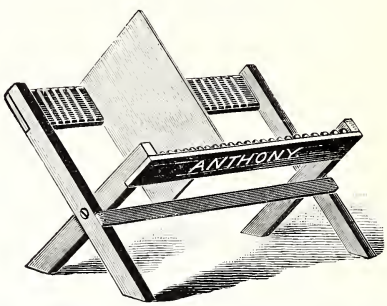

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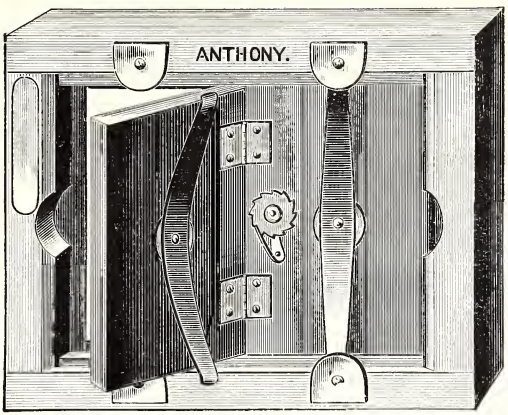

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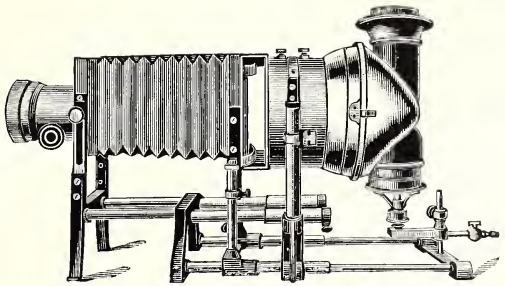

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